

## CLAIMS

What is claimed is:

1. An exhaust aftertreatment device comprising:
  - a housing extending axially along an axis and having an upstream inlet for receiving said exhaust, and a downstream outlet for discharging said exhaust;
  - an aftertreatment element in said housing for treating said exhaust;
  - 5 a diffuser in said housing de-focusing centralized velocity force flow against said aftertreatment element from said inlet.
2. The exhaust aftertreatment device according to claim 1 wherein said diffuser evens out exhaust flow profile across said aftertreatment element and enables efficient space utilization for contaminant reduction, capture and holding.
3. The exhaust aftertreatment device according to claim 1 wherein said aftertreatment element is a spiral wound member subject to central push-out damage, and wherein said diffuser minimizes said push-out damage.
4. The exhaust aftertreatment device according to claim 1 wherein said diffuser comprises a tapered wall extending from said inlet toward said aftertreatment element at an angle less than  $25^\circ$  relative to said axis and defining a transition duct expanding to larger cross-sectional areas as said wall extends from  
5 said inlet toward said aftertreatment element.
5. The exhaust aftertreatment device according to claim 4 wherein said angle is about  $20^\circ$ .
6. The exhaust aftertreatment device according to claim 1 wherein said housing has an axially extending outer wall confining said aftertreatment element therein, and wherein said diffuser comprises a tapered wall extending from said inlet

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towards said aftertreatment element and defining a transition duct expanding to larger cross-sectional areas as said tapered wall extends from said inlet towards said aftertreatment element, said tapered wall having a downstream end spaced laterally inwardly from said outer wall of said housing and spaced axially upstream from said aftertreatment element by an axial gap therebetween.

7. The exhaust aftertreatment device according to claim 6 wherein said tapered wall extends from inlet at an angle less than about 25°.

8. The exhaust aftertreatment device according to claim 6 wherein a projection line drawn along said tapered wall and extended therebeyond intersects said outer wall of said housing at said aftertreatment element.

9. The exhaust aftertreatment device according to claim 6 wherein the ratio of the length of said axial gap to the length of the lateral spacing between said outer wall of said housing and said downstream end of said tapered wall is less than 2.

10. The exhaust aftertreatment device according to claim 9 wherein said ratio is about 1.5.

11. The exhaust aftertreatment device according to claim 1 wherein said diffuser comprises a tapered wall extending from said inlet toward said aftertreatment element and defining a transition duct expanding to larger cross-sectional areas as said wall extends from said inlet towards said aftertreatment element, wherein said wall tapers at a compound angle defined by a first section extending from said inlet at a first angle relative to said axis, and a second section extending from said first section at a second angle relative to said axis, wherein said second angle is greater than said first angle.

12. The exhaust aftertreatment device according to claim 11 wherein said first angle is less than about 25°.

13. The exhaust aftertreatment device according to claim 11 wherein said second angle is greater than about 30°.

14. The exhaust aftertreatment device according to claim 1 wherein said diffuser comprises a central axially extending cylindrical tube and a plurality of vanes extending radially outwardly from said tube and curved to impart a non-axial flow direction component, wherein a first portion of said exhaust from said inlet flows axially within said tube, and a second portion of said exhaust from said inlet flows along said vanes and is directed by the curving of said vanes along a non-axial flow component direction.

15. The exhaust aftertreatment device according to claim 14 wherein said second portion of said exhaust is an annulus concentrically surrounding said first portion of said exhaust.

16. The exhaust aftertreatment device according to claim 15 wherein said first portion of said exhaust flows from said inlet axially through said tube to said aftertreatment element.

17. The exhaust aftertreatment device according to claim 15 wherein said tube is perforated.

18. The exhaust aftertreatment device according to claim 1 wherein said diffuser comprises a conically shaped perforated tube at said inlet.

19. The exhaust aftertreatment device according to claim 18 wherein said conically shaped perforated tube converges at an apex pointing axially downstream towards said aftertreatment element.

20. The exhaust aftertreatment device according to claim 18 wherein said conically shaped perforated tube has a tapered sidewall with uniform porosity, and wherein said tube has a diameter which decreases along the axial flow direction, forcing exhaust gas to flow through the perforations, such that the resulting  
5 flow through the perforations is more uniform.

21. The exhaust aftertreatment device according to claim 1 wherein said diffuser comprises a perforated plate between said inlet and said aftertreatment element, said plate having varied perforation porosity.

22. The exhaust aftertreatment device according to claim 21 wherein said housing has a chamber between said inlet and said aftertreatment element, and said plate extends laterally across said chamber and has a first central area and a second surrounding area, said second area having higher perforation  
5 porosity than said first area.

23. The exhaust aftertreatment device according to claim 1 wherein said diffuser comprises a crowned perforated plate between said inlet and said aftertreatment element.

24. The exhaust aftertreatment device according to claim 23 wherein said housing has a chamber between said inlet and said aftertreatment element, and said plate extends laterally across said chamber and is crowned convexly toward said inlet.

25. The exhaust aftertreatment device according to claim 24 wherein said plate has uniform perforation porosity.

26. The exhaust aftertreatment device according to claim 1 wherein said housing has a housing wall defining a chamber between said inlet and said aftertreatment element, said diffuser is in said chamber and spaced laterally inwardly from said housing wall, said diffuser extending from said inlet toward said aftertreatment element, and comprising a support flange in said chamber in said housing and axially spaced between said inlet and said aftertreatment element and extending laterally inwardly from said housing wall to said diffuser to support the latter.

27. The exhaust aftertreatment device according to claim 26 wherein said diffuser is a tapered wall spaced laterally inwardly of said housing wall and extending from said inlet towards said aftertreatment element and defining a transition duct expanding to larger cross-sectional areas as said tapered wall extends from said inlet towards said aftertreatment element.

28. The exhaust aftertreatment device according to claim 26 wherein said diffuser extends from said inlet to an inner diffuser end axially spaced from said aftertreatment element and laterally spaced inwardly from said housing wall, and wherein said support flange extends laterally inwardly from said housing wall to said inner diffuser end to support the latter.

29. The exhaust aftertreatment device according to claim 1 wherein said diffuser is a hyperbolic tube.

30. The exhaust aftertreatment device according to claim 1 wherein said diffuser comprises a tapered wall tapering at a multi-compound angle.

31. The exhaust aftertreatment device according to claim 1 wherein said diffuser comprises a tapered wall tapering in a continuous diverging curve.

32. The exhaust aftertreatment device according to claim 1 wherein said diffuser comprises a tapered wall tapering at a multi-compound angle in a continuous diverging curve.

33. The exhaust aftertreatment device according to claim 1 wherein said aftertreatment element is a catalyst element.

34. The exhaust aftertreatment device according to claim 1 wherein said aftertreatment element is a filter element.

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